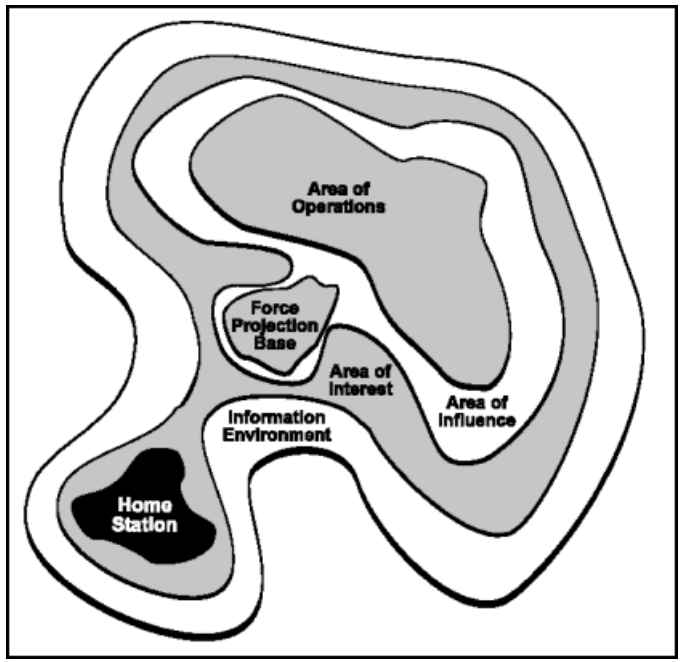
Information in Command and Control: Connecting Mission Command and Social Network Analysis



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"The change from atoms to bits is irrevocable and unstoppable.“
--- N. Negroponte, *Being Digital*, 1995.

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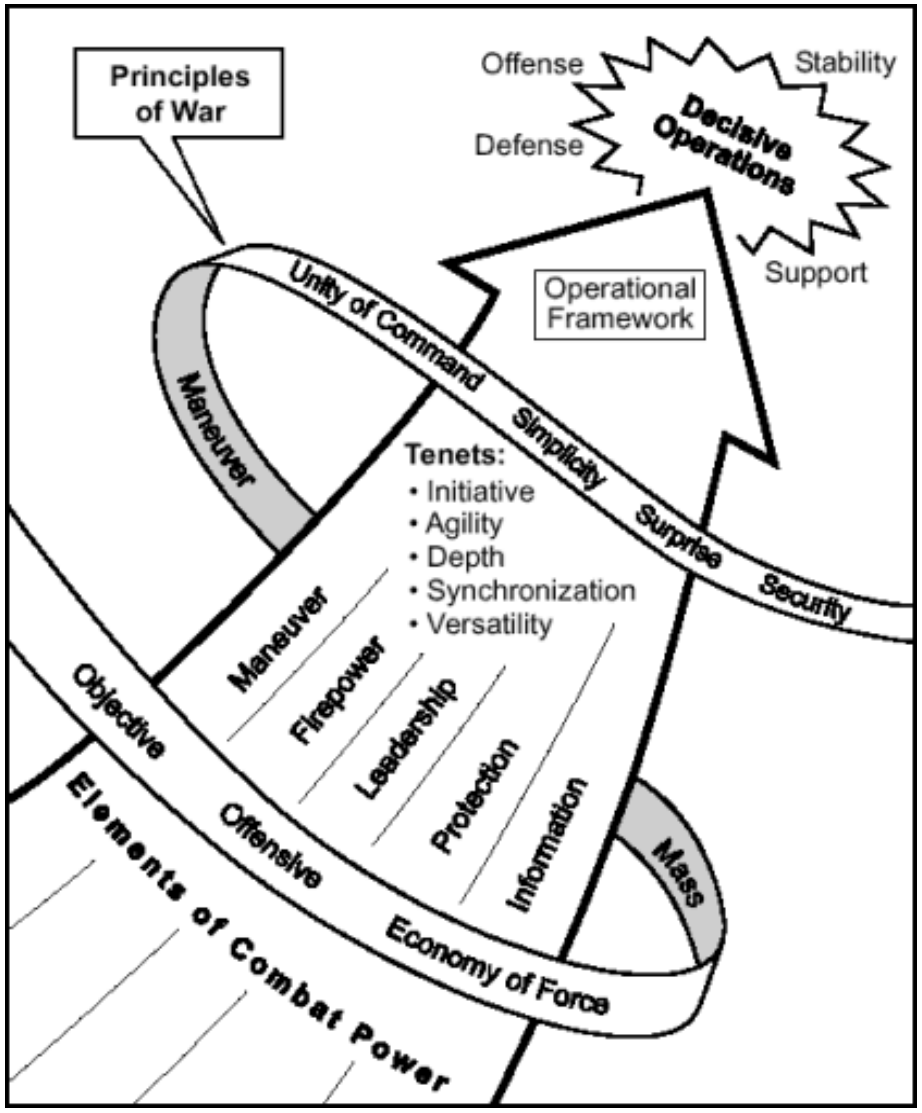
The Future Information Environment

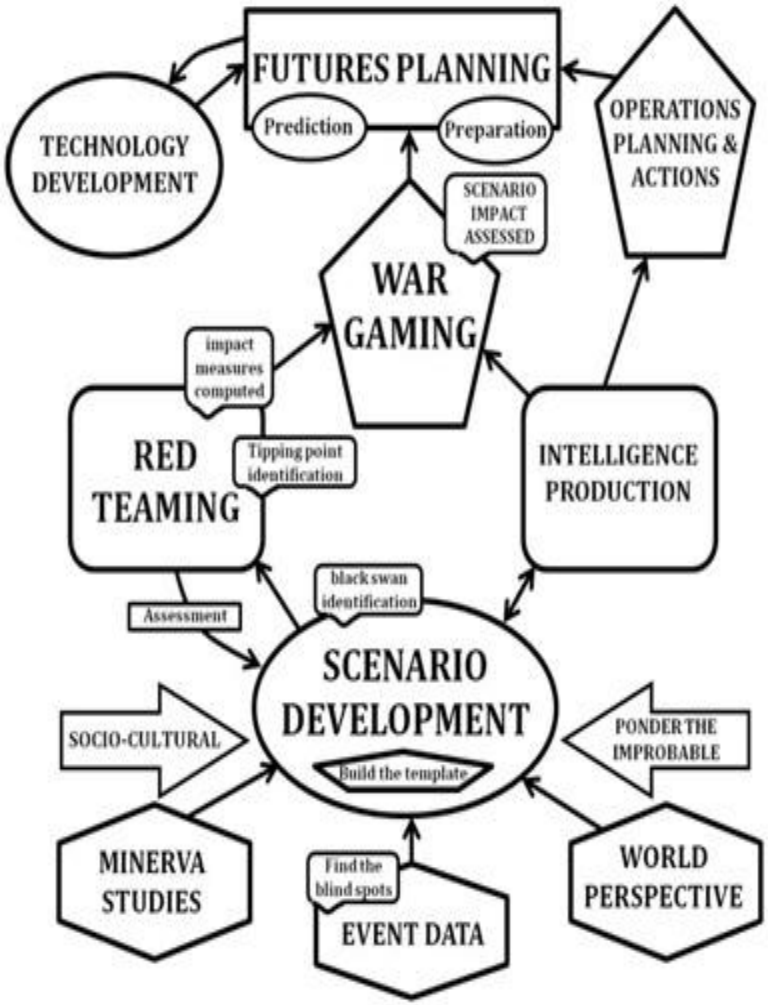


- Military is enhancing data collectors & sensors (drones & robots) -- producing a data deluge.
- All levels are overflowing with information that needs ordering, refining, fusing to be timely & accurate.

What's Happening

- Society's transition from physical- to information-centric impacts thinking & methodology, structures & processes, modeling & analysis.
- Steep learning curve: Human-created problems involving information behave differently than physical ones.
- Pace is fast and furious.
- Need more human science & new kinds of models & math.

Informatics in Military Operations



- Information science (IS) involves collecting, fusing, exploiting information to produce intelligence & situation awareness that enables command & control.
- IS provides a powerful & effective processing system that lies at the heart of planning, commanding, controlling & implementing future operations.

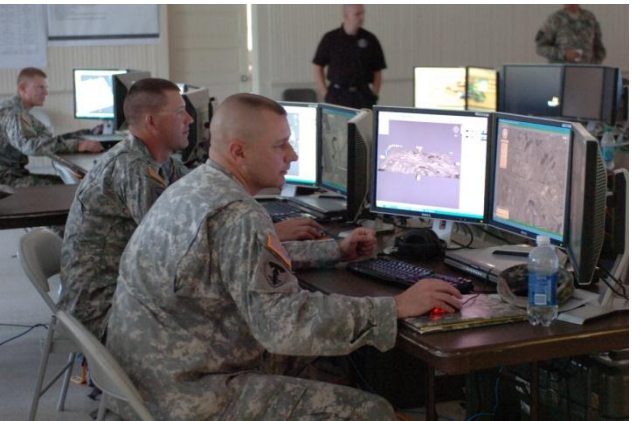
Recent Experience with Military IS

- CPOF and BFT allow commander to better see own units in order to respond
- TIGR flattens the intelligence hierarchy
- Does not change much about the way we operate, mainly enables commanders to do the same things faster or better

Tactical Intelligence Ground Reporting

Blue Force Tracker

Command Post of the Future



Problems with current systems

- Current IS tell a lot about us, something about the enemy, and nothing about the people.

- Require a user to input all data

- Does not operate across disciplines

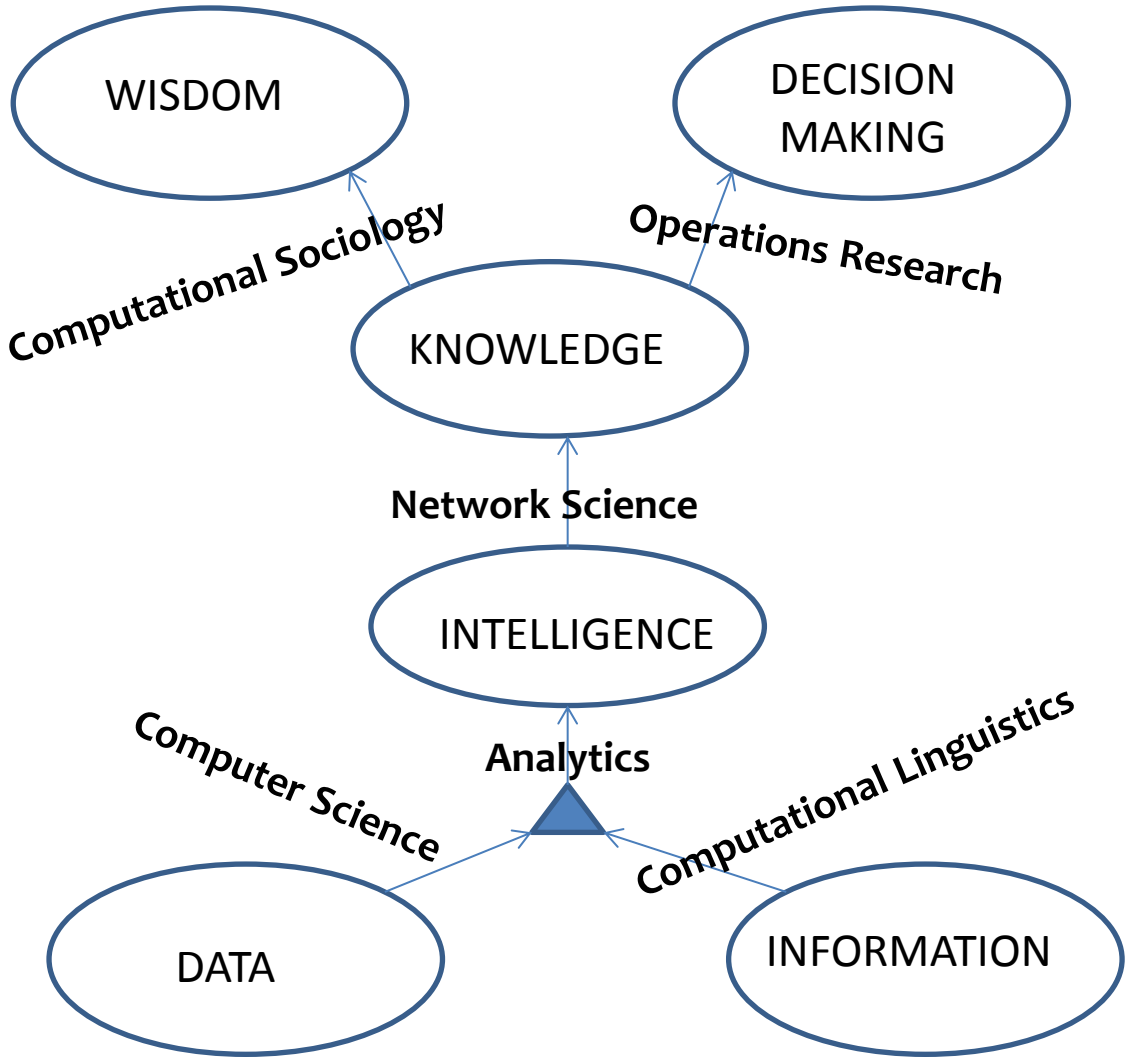
Good News

- Society (& Military) is making strides in understanding issues in the information-centric world.
- Progress by integrating modes of understanding (theory, modeling, application, & practice); integrating levels of perception (data, information, intelligence, knowledge, & wisdom); & maturing the IS disciplines.

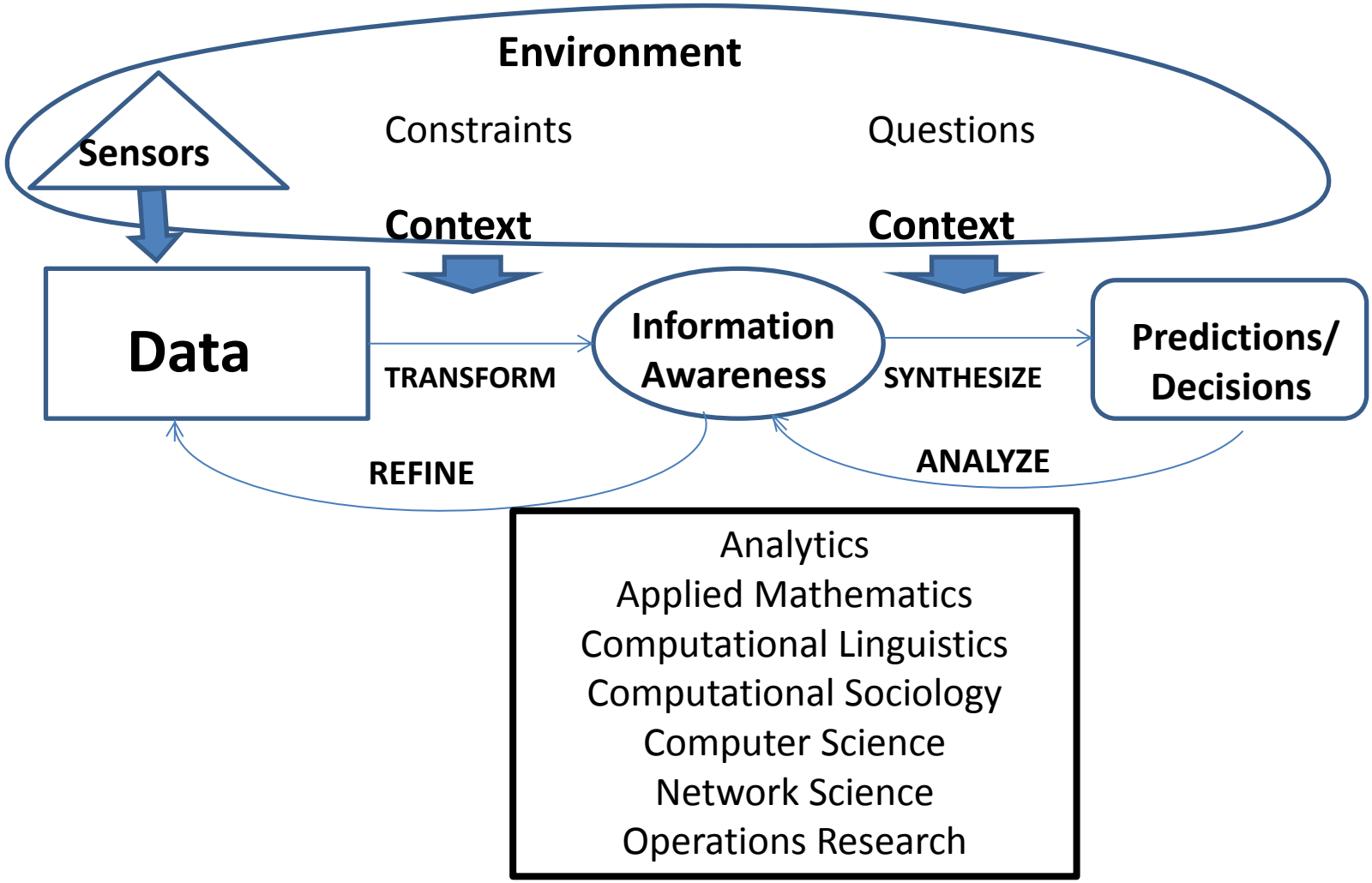
Development of Processing Tools

- Useful tools & methods perform text extraction, data mining, hard-soft information fusion, measurement of value & utility, controlling, & optimizing.
- IS (network) models how individuals interact, exchange ideas, share situational information, provide support, & conduct business.
- In IS world, the social sciences (especially social network analysis) are a growing part of the conversation.

Classic (Outdated), Reductive DIKW Information Processing Model



Interdisciplinary, Non-reductive Model for future Information Processing (building a Watson)

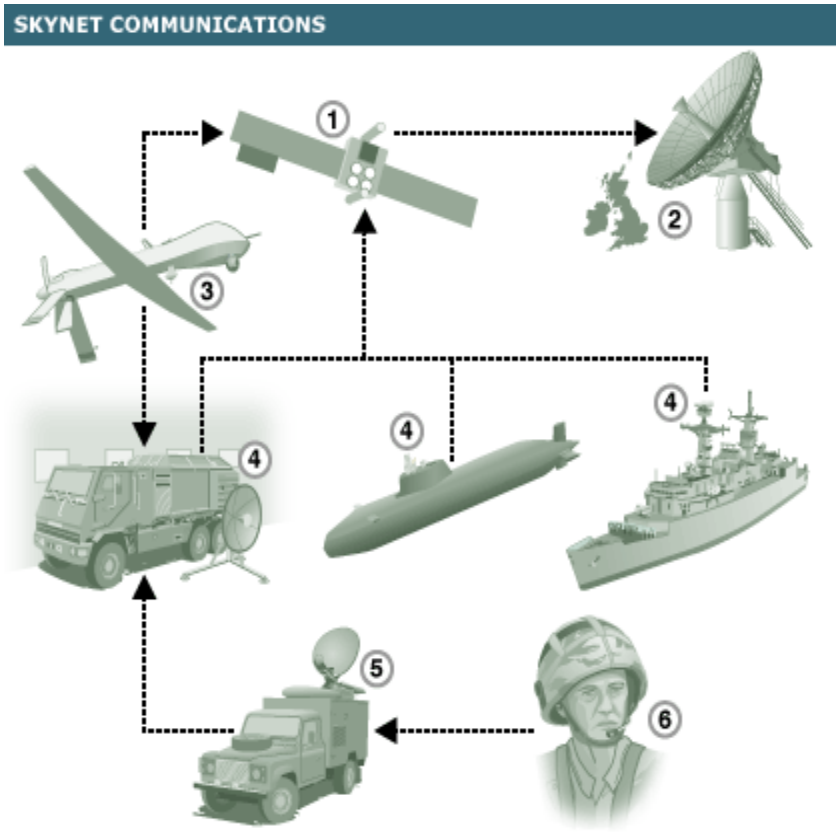


What is needed

A system that…

- Spans several fields of knowledge
- Natural interface
- Can be a useful participant in the planning and analysis process

IS Perspectives and Disciplines



- Analytics
- Applied Mathematics
- Computational Linguistics
- Computational Sociology
- Computer Science
- Network Science
- Operations Research

Challenges

- What does the future battlefield look like?

- Massive numbers of data feeds
- Missing/wrong data
- Intentional stovepiping to protect intel

- ***Gaining user trust***

Good News of Progress thru IS

- OR assembles new paradigms for intelligence processing that rely on computers & robots to make judgments & set priorities.
- Analytics evoke military systems with less redundancy & more flexibility.
- Network Science suggests replacing hierarchical structures with dynamic horizontal organizations for cooperation, adaptation & diversity.
- Computer Science provides algorithms in the data-rich, cyber/information world.
- Computational Linguistics tackles complex textual info challenges.
- Computational Sociology produces innovative doctrine for decentralized and collective decision making & information staff work.
- Applied Mathematics sets limitations & capabilities by developing language & methods to build complex solutions & models.

- IS will enable major shifts in current military thinking and doctrine.

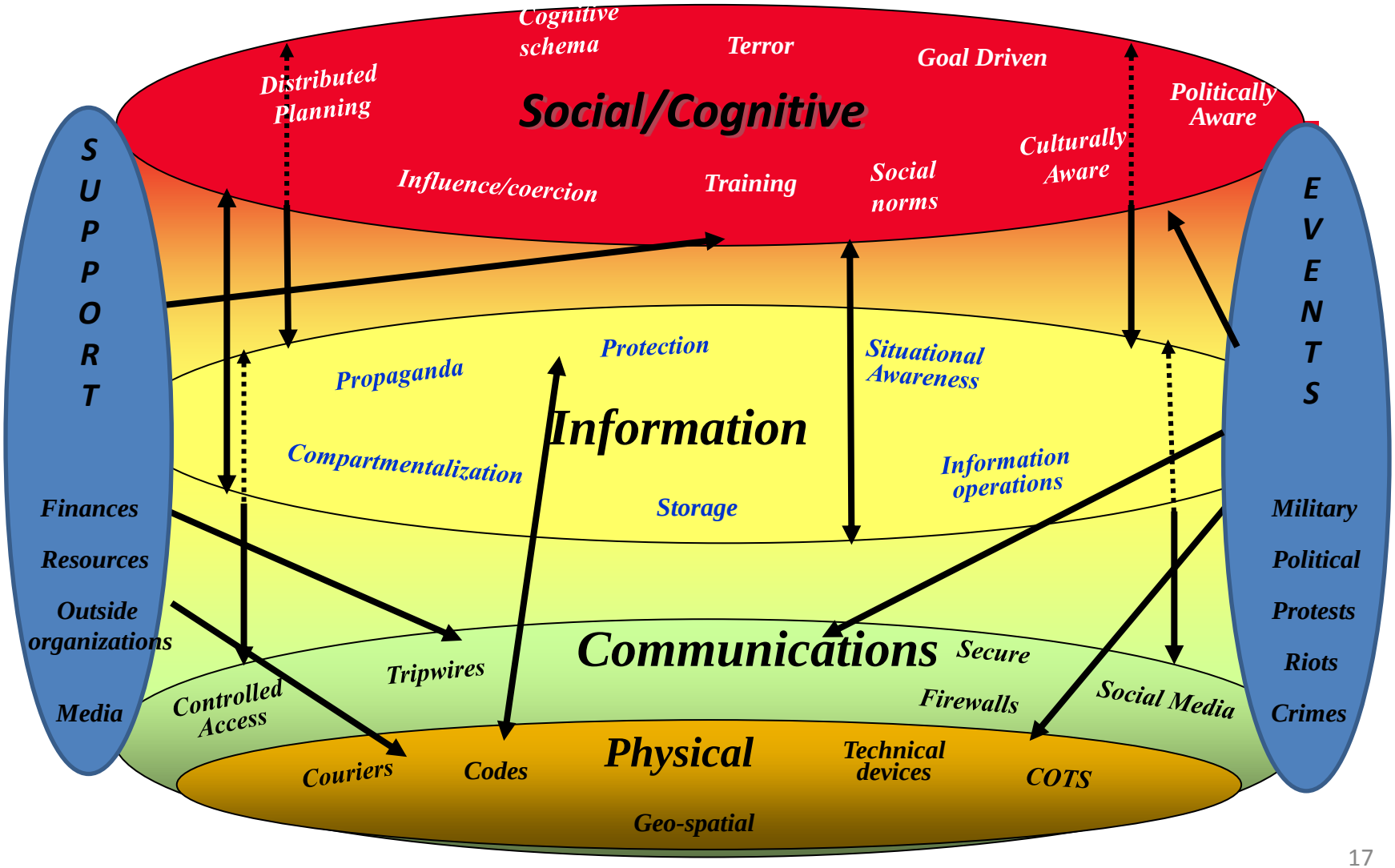
There is Bad News

- The military (Army Research) does not have a core competency in IS (except elements of CS-ISR & some network science).
- The failure of COIN & modern net-centric operations to live up to their hype of using information is a setback to IS reputation in the military. (It's the old AI story – too high expectations)
- IS is deep --- spans tactical to strategic levels, but is it not yet efficient
- IS is broad --- spans doctrine to networked systems, intelligence to operations to logistics, but that makes systems more complicated.

However, More Good News

- Research community is aware of shortcomings & improving (priorities --- Network science, Advanced computing, Human science, Intelligent systems.)
- Problem-solving, situation awareness, & decision-making enable & synergize operations through better plans, more agile systems, & enhanced doctrine.
- IS is beginning to recognize the non-reductionism of information processing. Military leaders are seeing the world as chaotic, uncertain, & complex.

Building Watson from the Network Science Multi-layered Framework



Mission Command Embraces Complex IS

- Future operations require broad, agile command to synchronize opns. MC embraces the complexity of operations to create that agility.
- MC defines roles -- Joint, Interagency, Intergovernmental partners & the human dimension.
- MC combines art of command & science of control. The art of command involves using information to understand, visualize, describe, direct, lead, develop teams. The science of control includes planning, preparing, executing, assessing, & conducting information opns, as well as cyber.
- MC builds information-savvy, agile teams that anticipate transitions, accept risk to create opportunities, plan on the move, adapt, innovate & conduct information opns.

There are more steps

(paradigm shift to Watson or just extrapolation of trends?)

- As missions evolve to a full-spectrum (stability operations, cyber, peace-keeping), is it time to evolve the principles of operations to include more informational elements?
- The principles of war & fundamentals of operations & strategy were established before we understood that bits of information were as important as atoms.
- Collaborative decision-making vs. unity of command; and embracing the complexity of warfare through machine autonomy (AI) vs. making plans simple & detailed.
- These ideas deserve further study and analysis.

Future Challenges for Watson

- Mobile Internet Design (security, capability)
- Automation of information/intell processing (What happens when the computer writes a better report than the analyst or the design alternatives are not understood by the commander?)
- Cloud Computing (How do you control a cloud of information?)
- How does Watson deal with nuances of language systems?
- How does Watson develop Adaptive Supply Chain Systems, especially for Water, Food, Energy Distribution?
- Can Watson help cmd & ctrl in Cyberspace?

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